



# Economic and Social Council

Distr.: General  
9 July 2021

Original: English

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## Economic Commission for Europe

### Committee on Sustainable Energy

#### Thirtieth session

Geneva, 22-24 September 2021

Item 7 of the provisional agenda

#### Future work of the Committee on Sustainable Energy

## Decarbonizing transport with natural Gas – draft policy recommendations

Note by the secretariat

### I. Background

1. The two-year project “Improving capacities of the United Nations Economic Commission for Europe (ECE) member States to decarbonize the transport sector by increasing the use of natural gas as a motor fuel”<sup>1</sup> funded by the Russian Federation, involves Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Bulgaria, Kazakhstan, Kyrgyzstan, Moldova, North Macedonia, Romania, Serbia, Tajikistan, Turkmenistan and Uzbekistan. The project started in 2020.
2. The project is based on the premise that natural gas – with its environmental, economic, availability and logistic advantages – is a serious alternative to petrol and diesel because of its technical and economic viability in any mode of transport: on-road, maritime, or rail. Switching to compressed (CNG) or liquefied natural gas (LNG) is an effective way to reduce pollution from road transport. CNG and LNG may represent a bridge to more sustainable and decarbonized mobility in the future.
3. In the short term, the project is conceived to improve the understanding of ECE member States of the possible benefits of using natural gas in transport. In the longer-term, the project is expected to contribute to reducing pollution from road transport and hence improving urban air quality in large cities in the region.
4. Under the project a report has been prepared that assesses the state of development of CNG and LNG refuelling and storage infrastructure in the project countries, analyses competing fuelling options, and presents recommendations on removing regulatory, legal, economic, technical and public perception barriers to the use of gas in transport.

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<sup>1</sup> <https://unece.org/sustainable-energy/project-gas-transport>



## II. Introduction

5. Natural gas plays an increasingly important role in improving access to affordable, reliable, sustainable, and modern energy, and in achieving other targets of Sustainable Development Goal (SDG) 7. From a developmental perspective, increasing the share of gas in transport may help attain a wide range of SDGs, such as: SDG 1 (no poverty), SDG 5 (gender), SDG 8 (decent work and economic growth), SDG 9 (industry, innovation and infrastructure), SDG 11 (inclusive, safe, resilient and sustainable cities), SDG 12 (sustainable consumption and production patterns), and SDG 13 (climate action). Annex I presents the correlations between natural gas vehicle (NGV) market development and the sustainable development framework.

6. The ECE Group of Experts on Gas believes that gas is an effective vector for decarbonizing the energy sector and improving its overall efficiency, notably in transport.

## III. Life Cycle Analysis of Competing Fuelling Options

7. Many countries are adopting stricter environmental requirements for vehicles because of pollution linked to the use of traditional liquid fuels. As a result, many automakers have committed to achieving zero emissions and producing climate and urban environment friendly vehicles.

8. Natural gas, hydrogen and electricity are considered the most promising alternatives to petrol and diesel. Among these alternatives, natural gas is the most affordable source of energy that can have a significant impact on the environment.

9. From a life cycle analysis perspective, it is important to assess not only the final emissions from fuel combustion but also the full cycle of pollutant emissions at all stages of vehicle production and utilization and of fuel production and processing.

10. Life cycle analysis indicates that

(a) Emissions from natural gas vehicle manufacturing are the same as for petrol cars, but significantly less than emissions from those of electrical vehicles (including batteries);

(b) Natural gas is preferable to diesel and gasoline; and

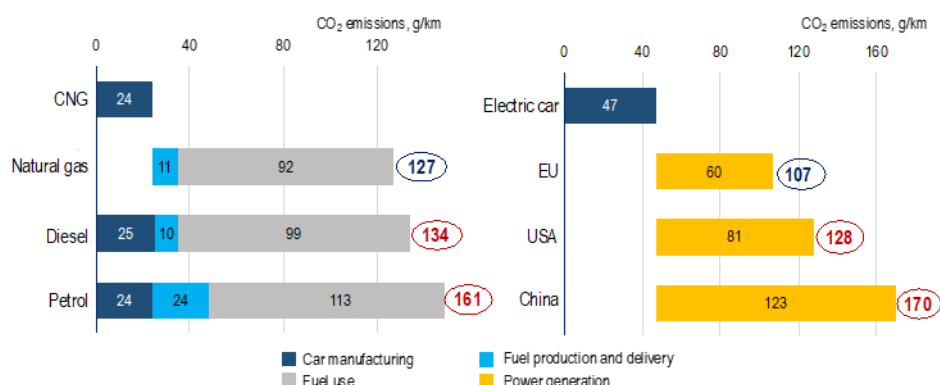
(c) When mixtures of natural gas and biogas or hydrogen blends are used as fuel, gas remains competitive with electric vehicles over the long run in terms of environmental impacts.

11. The cradle-to-grave greenhouse gas (GHG) emission study<sup>2</sup> by NGVA Europe shows that electric vehicles can be effective only if there is an increased share of renewables in the power mix. According to the study, an integrated approach can involve the use of municipal and agricultural waste for the production of biogas. Such solutions allow for synergies that can improve environmental quality. By consuming waste as a fuel resource, the transport sector transforms itself from being a producer of to being an absorber of GHG emissions.

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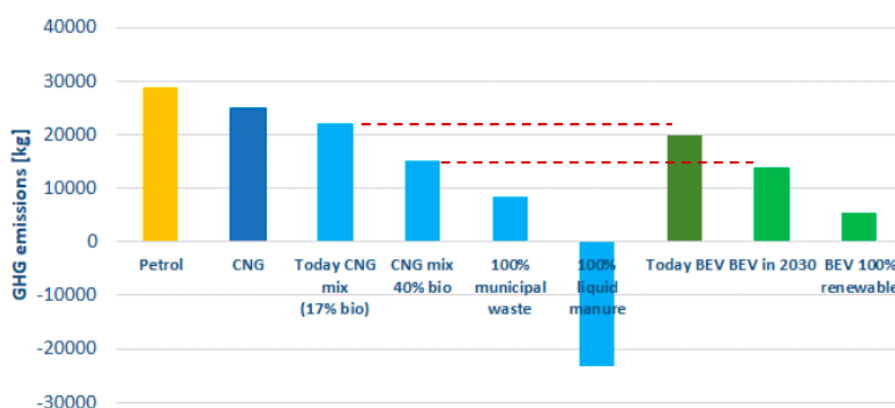
<sup>2</sup> <https://www.ngva.eu/medias/going-beyond-well-to-wheel-life-cycle-emissions/>

Figure I  
Estimation of full life cycle CO<sub>2</sub> emissions for different types of fuel



Source: Volkswagen Group.

Figure II  
Cradle to Grave GHG emissions, total



Source: NGVA Europe.

Note: BEV = Battery electric vehicle

12. Carbon dioxide (CO<sub>2</sub>) is not the only compound with an environmental impact in transport. According to the International Gas Union, natural gas technologies, as opposed to oil-based fuels, reduce pollutant concentrations in the air, including particulate matter, nitrogen oxides (NO<sub>x</sub>), sulphur dioxide and ozone, providing for both cleaner air together and climate benefits.

13. The analysis of the environmental and economic efficiency of the transition to natural gas should consider the energy mix of every country in detail. The use of natural gas vehicles does not require investments in power generation, while the transition to e-mobility implies a mandatory change in the power mix. A detailed analysis of transport transition models is needed for each country, taking into account the prospects for energy sector development.

## IV. Natural Gas Vehicles Market Development

14. The project beneficiary countries are at different stages of economic development, have a different transport market shape, and energy and transport policies. Deployment of natural gas in the energy and fuel sectors vary considerably as well. The main indicator for the NGV market is the number of filling stations and vehicles using natural gas.

15. NGV markets in the project beneficiary countries can be segregated into three groups:
- (a) Initial stage of market development;
  - (b) Emerging markets;
  - (c) Mature markets.
16. Countries in the initial stage of development have a number of CNG stations less than ten, and the dynamics of the NGV fleet is quite low. This is the situation in Azerbaijan, Bosnia and Herzegovina, Kyrgyzstan, North Macedonia, Romania, and Turkmenistan. Further analysis of these countries will focus on barriers to market development.
17. Emerging markets feature a number of CNG stations from ten to one hundred, which is the situation in Belarus, Bulgaria, Kazakhstan, Republic of Moldova, Serbia, and Tajikistan. The conditions for successful NGV market development are promising.
18. Mature NGV markets are characterized by a high level of saturation with filling stations and low potential for further growth. NGV markets are mature in Armenia and Uzbekistan. The guidelines for mature markets focus on safety and control of the circulation of CNG cylinders.
19. NGV market development potential also depends on the level of motorization and the levels in the project countries vary from 37 vehicles per 1,000 inhabitants in Tajikistan to 393 vehicles per 1,000 inhabitants in Bulgaria. Belarus, Bulgaria, and Romania have the greatest potential for NGV market development in terms of volumes. On the other hand, countries with comparatively low motorization (such as Azerbaijan) can be an attractive platform for an accelerated transition to the use of natural gas as a motor fuel.
20. A price analysis of the project countries indicates that using natural gas could reduce fuel costs by 20-60 per cent. The use of CNG fuel reduces costs significantly for vehicle owners. From this perspective, the most promising NGV markets (with the largest financial impact from the transition to NGVs) are in Azerbaijan, Belarus, Republic of Moldova, and Uzbekistan.
21. In some countries the price of liquefied petroleum gas (LPG) is lower than for CNG (for example, in Bulgaria and Romania). This can present a strong barrier for NGV market development. For these countries, focusing on specific pilot projects in selected segments of the transport sector (such as water transport) is more beneficial.
22. Another important factor for NGV market development is the access to natural gas and the rate of natural gas network coverage. The higher the rate, the better the terms for CNG infrastructure development. Low natural gas network coverage means that there is the potential for effective use of small-scale LNG for transport transition (for example, in Serbia, Bosnia and Herzegovina, North Macedonia). Azerbaijan, Belarus, Kazakhstan, Republic of Moldova, and Turkmenistan have the best terms for CNG infrastructure development.
23. From an environmental point of view, Bosnia and Herzegovina, Kyrgyzstan, North Macedonia, Republic of Moldova, and Serbia demonstrate the highest carbon intensity of road transport. These countries need a quick and effective mechanism for transport transition. An NGV market can be a virtuous solution.
24. There is a difference between CNG and LNG. While CNG is effective for buses and taxis in the inner cities, LNG is effective for long-distance trucks, and some other types of transport and off-road machinery with high fuel consumption. Countries with international transit routes have significant potential to develop a small-scale LNG market.

## V. Policy Recommendations

25. Based on an overview of NGV markets in the project countries, the common principles and recommendations for development of an NGV market include:
- (a) *The transport transition should be related to the energy transition.* When coal does not dominate the primary energy supply, electric vehicles can be an option for

decarbonization. It is recommended that the energy mix in all of the project countries be evaluated to provide the basis for a life cycle comparison of electric vehicles and NGVs;

(b) *Each project country should consider a comprehensive development programme for an NGV market*, including different segments of the transport sector: private cars, buses, light commercial vehicles (LCVs), heavy trucks, construction and communal machinery, agricultural and quarry machinery, railway transport, and water transport. Such a programme should include a layout for gas station infrastructure (CNG and LNG) with pipeline connection and supporting infrastructure (such as cylinder inspection centres, service centres, retrofitting points). The layout should be based on the potential demand for different segments of the transport sector. Where natural gas network coverage is low, creation of infrastructure for small-scale LNG could be considered which would allow the start of the transition in commercial segments of the transport sector, primarily long-distance heavy trucks and machinery;

(c) *Technical regulation requires harmonization between different countries*. The relevant UN regulations, including but not limited to, Regulation Numbers 15, 49, 83, 110, 115, 133<sup>3</sup> should be harmoniously implemented for NGV vehicles in the project beneficiary countries. The number of infrastructure installations should be calculated through demand analyses. Whenever possible, gas station infrastructure should be located near highways with access to gas networks. As most of the project countries are connected by highways and possible CNG and LNG ‘corridors’, the creation of a unified interstate register of cylinders to control their circulation and simplify procedures for the end user when crossing borders is recommended;

(d) *Creation of promotional video materials clarifying the specifics and benefits of CNG and LNG use* is required in partnership with industrial associations in the project countries. Popularisation of the use of CNG and LNG depends on awareness of the general public. Potential customers in many countries are not aware of the opportunities offered by NGVs. Most of the existing NGV video-materials needs to be updated to meet modern standards and be globally promoted.

<sup>3</sup> Addenda to the 1958 Agreement concerning the Adoption of Harmonized Technical United Nations Regulations for Wheeled Vehicles, Equipment and Parts which can be Fitted and/or be Used on Wheeled Vehicles and the Conditions for Reciprocal Recognition of Approvals Granted on the Basis of these United Nations Regulations:

- **UN Regulation No. 15:** Uniform provisions concerning the approval of vehicles equipped with a positive-ignition engine or with a compression-ignition engine with regard to the emission of gaseous pollutants by the engine - method of measuring the power of positive-ignition engines - method of measuring the fuel consumption of vehicles;

- **UN Regulation No. 49:** Uniform provisions concerning the measures to be taken against the emission of gaseous and particulate pollutants from compression-ignition engines for use in vehicles, and the emission of gaseous pollutants from positive-ignition engines fuelled with natural gas or liquefied petroleum gas for use in vehicles;

- **UN Regulation No. 83:** Uniform provisions concerning the approval of vehicles with regard to the emission of pollutants according to engine fuel requirements;

- **UN Regulation No. 110:** Uniform provisions concerning the approval of:

Specific components of motor vehicles using compressed natural gas (CNG) and/or liquefied natural gas (LNG) in their propulsion system;

Vehicles with regard to the installation of specific components of an approved type for the use of compressed natural gas (CNG) and/or liquefied natural gas (LNG) in their propulsion system;

- **UN Regulation No. 115:** Uniform provisions concerning the approval of:

Specific LPG (liquefied petroleum gases) retrofit systems to be installed in motor vehicles for the use of LPG in their propulsion system;

Specific CNG (compressed natural gas) retrofit systems to be installed in motor vehicles for the use of CNG in their propulsion system;

- **UN Regulation No. 133:** Uniform provisions concerning the approval of motor vehicles with regard to their reusability, recyclability and recoverability.

## **VI. Country Specific Guidelines**

### **Armenia**

26. The share of natural gas share in the energy mix in Armenia is forecast to increase, which is pivotal for sustainable development of the energy and transport sectors. The country's absolute GHG emissions are among the lowest in the world. With the current and forecast structure of the fuel and energy mix, the use of natural gas in transport is both economically and environmentally advantageous.

27. The development of electric vehicles will require substantial investment in renewable energy technologies. Given the current socio-economic situation of the country, expensive electric vehicle projects are unlikely.

28. To support a free-market model, development of a framework for the safety of CNG filling stations and regulations for the replacement and exchange of CNG cylinders is needed.

29. The level of motorization in Armenia is 111 units per 1,000 inhabitants, thus, there is room to increase the country's vehicle fleet. Active promotion of natural gas as a motor fuel will allow consumers to make a rational choice.

### **Azerbaijan**

30. Reducing emissions from the transport sector is important for Azerbaijan's economic, environmental and climate commitments.

31. The current price of CNG is 55 per cent lower than petrol, making it attractive for potential customers. The gas network coverage is 96 per cent which is favourable for development of a network of CNG filling stations.

32. Gas infrastructure is promising for transit transport due to plans to develop international highways. Due to the neighbouring NGV markets (the Russian Federation and Iran), the Iran–Azerbaijan–Russian Federation CNG corridor project offers a lot of potential.

### **Belarus**

33. Belarus' comprehensive approach to development of an NGV market involves expansion of the gas distribution network, development of gas station infrastructure and services, as well as promotion of natural gas as a motor fuel among potential customers.

34. The required investments and potential socio-economic and environmental effects of an NGV market in Belarus can only be assessed after all the potential locations for infrastructure facilities are determined.

### **Bosnia and Herzegovina**

35. The energy mix in Bosnia and Herzegovina is mostly based on coal. Without significant investments in the power sector, the use of electric vehicles would only worsen the indicators of GHG emissions.

36. The main barrier to development of an NGV market development is the low coverage of the gas distribution network. Creation of infrastructure for small-scale LNG is recommended as is starting the transition of the commercial segments of the transport sector, primarily long-distance heavy trucks and machinery. CNG for the taxi, LCV and individual car sectors can be obtained through LNG regasification.

37. A pilot project in the field of small-scale LNG for trucks, mainline bus transport and quarry machinery should be considered.

## Bulgaria

38. Based on life-cycle analysis, it can be concluded that a large share of coal in the power mix does not allow effective use of electric vehicles.
39. The basic infrastructure for development of an NGV market has already been created in Bulgaria. There are though some barriers to further development of the NGV market, including low gas distribution network coverage and low prices for LPG (natural gas is 44 per cent less expensive than petrol and diesel).
40. Given the outdated vehicle fleet in Bulgaria and the average income of the population, natural gas is the most affordable fuel, especially in areas with heavy traffic or high fuel consumption (such as river and maritime transport).
41. The required investments and potential socio-economic and environmental effects of the NGV market can only be assessed after all potential locations for infrastructure facilities are determined.
42. Additional obligations to guarantee protection of the environment in the sectors with high fuel consumption can make natural gas more attractive for the final customers.

## Kazakhstan

43. The main obstacles for Kazakhstan in development of an NGV market are limited access to natural gas and insufficient financing and support from the Government. Further development of the market requires promotion of NGVs nationwide
44. CNG is 40 per cent cheaper than petrol which offers an economic incentive to switch to natural gas. Hazardous air urban quality is another stimulus.
45. In areas with low gas distribution network coverage it is advisable to consider creating an infrastructure for small-scale LNG and start the transition from commercial segments of transport sector, primarily long-distance heavy trucks and machinery. CNG for taxi, LCV and individual cars segments can be obtained by LNG regasification.
46. The construction of the Western Europe - China corridor provides an incentive for LNG infrastructure development.

## Kyrgyzstan

47. Gas network coverage and fuel pricing conditions in the country limit the potential for development of an NGV market.
48. Given the economic circumstances in the country and the environmental conditions in its capital Bishkek, it is recommended to continue implementation of a pilot project converting public transport to environmentally friendly fuels. The high share of hydropower in the power mix makes the use of electric vehicles potentially quite effective for decarbonization. At the same time, old vehicles could be retrofitted to CNG thus avoiding big investments in new vehicles.
49. In the event of significant depreciation of fixed assets and transport vehicles, the priority for market participants should be renovation and renewal of production equipment, as well as the renewal of the transport fleet.
50. Further pilot initiatives for development of small-scale LNG for mainline transport and autonomous power generation should be considered.

## North Macedonia

51. The energy mix of the country is mostly based on coal. Without significant investments in the power sector, deployment of electric vehicles would only worsen GHG emission indicators.

52. Taking into account the high carbon intensity and the difference between the price of natural gas and petroleum fuel, there is a fundamental necessity to develop an NGV market.

53. The main barrier to development of an NGV market is the low coverage of the gas distribution network. It is recommended that consideration be given to creating infrastructure for small-scale LNG and to start the transition of the commercial segments of the transport sector, primarily long-distance heavy trucks and machinery. CNG for the taxi, LCV and individual car sectors can be obtained through LNG regasification.

54. It is recommended to start a pilot project in small-scale LNG for trucks, mainline bus transport and quarry machinery.

## **Republic of Moldova**

55. The high share of natural gas in the energy mix and the developed gas distribution network provide an opportunity to develop an NGV market. However, a well-balanced sustainable scenario for economic, environmental and social objectives is needed.

56. The difference in the prices of CNG and gasoline (CNG is 55 per cent cheaper) makes NGVs attractive. Retrofit of the existing old vehicle fleet and a switch to natural gas would provide a quick and cheap solution to help mitigate the environmental challenges.

57. Where the gas distribution network coverage is low, it is recommended to consider the possibility to create infrastructure for small-scale LNG and to start the transition of the commercial segments of the transport sector, primarily long-distance heavy trucks and machinery.

58. The required investments and potential socio-economic and environmental effects of an NGV market can only be assessed after all potential locations for infrastructure facilities are determined. At the last stage, additional state support measures would be needed.

59. Additional obligations to guarantee protection of the environment in segments with high fuel consumption can make natural gas more attractive for final customers.

## **Romania**

60. Barriers to development of an NGV market in Romania include a low distribution network coverage and low prices for LPG (natural gas is 60 per cent less expensive than petrol).

61. Natural gas remains the most affordable alternative, especially in segments with high fuel consumption, such as river transport.

62. The required investments and potential socio-economic and environmental effects of an NGV market can only be assessed after all potential locations for infrastructure facilities are determined. During the final stages of implement an NGV market in Romania, additional state support measures should be considered.

63. Additional obligations to guarantee protection of the environment in segments with high fuel consumption could make natural gas more attractive for final customers.

## **Serbia**

64. The energy mix of the country is mostly based on coal. Taking into account the high level of carbon intensity and the difference between the prices of natural gas and petroleum fuel, development of an NGV market is needed.

65. The main barrier to development of an NGV market is the low coverage of the gas distribution network. In view of this, it is recommended to consider creating the infrastructure for small-scale LNG and to start the transition from the commercial segments of the transport sector, primarily long-distance heavy trucks and machinery. CNG for the taxi, LCV and individual car segments can be obtained through LNG regasification.



66. Implementation of a pilot project in small-scale LNG for trucks, mainline bus transport and quarry machinery is recommended.

## **Tajikistan**

67. Gas network coverage and gas supply restrictions constrain development of an NGV market in Tajikistan. Given the economic situation and the environmental conditions in the country, it is recommended that pilot projects aimed at converting public transport to environmentally friendly fuels be implemented. Hydro-supply is seasonal making it difficult to develop a sustainable e-mobility concept. At the same time, public transport and personal cars can be easily retrofitted to CNG without large investments in new vehicles.

68. Pilot initiatives for the development of small-scale LNG for mainline transport and autonomous power generation should be considered.

## **Turkmenistan**

69. Turkmenistan is a sparsely populated country with significant natural gas reserves and a high level of gas network coverage. All the basic prerequisites for transition of the transport sector to natural gas exist in the country. The transition of the transport sector would require a complex programme of market development.

70. The required investments and potential socio-economic and environmental effects of an NGV market can only be assessed after all potential locations for infrastructure facilities are determined. During the final stages of implementation of an NGV market additional state support measures should be considered.

71. Small-scale LNG projects should also be viewed as an additional way to export gas to neighbouring countries.

## **Uzbekistan**

72. Uzbekistan has made significant progress to transition its transport sector to natural gas. Favourable factors contributing to this success include the adoption of a comprehensive state policy on shifting transportation to natural gas, as well as a liberal market development model that allows market participants to become successful entrepreneurs in the emerging market of natural gas fuel.

73. The free-market model, however, requires establishment of a framework for the safety of CNG filling station safety and regulations for circulation, replacement and exchange of CNG cylinders.

74. Since the level of motorization in Uzbekistan is only 70 units per 1,000 inhabitants, there is a sufficient room for the country's growing vehicle fleet. Active promotion of natural gas as a motor fuel will allow consumers to make a rational choice.

## **VII. Conclusions**

75. Natural gas for vehicles can be an effective solution for transition of the transport sector. It meets at least eight Sustainable Development Goals and allows balancing of social, environmental and economic factors. The basic qualities that make use of natural gas attractive for vehicles are:

- The cost of natural gas is lower than petrol or diesel
- The price of natural gas vehicles is relatively low compared to electric vehicles
- Use of natural gas as a motor fuel for water transport avoids environment-damaging fuel spills

- Use of natural gas for vehicles results in a reduction of GHG emissions and elimination of most of the harmful substances absorbed by particulate matter that results from petrol and diesel-fuelled vehicles
- The use of biogas from municipal and agricultural waste allows for implementation of a comprehensive approach to solve environmental problems
- The transition to e-mobility implies a mandatory change in the power mix, while the transition to NGVs does not require investments in power generation
- CNG and LNG technologies are mature and can be easily implemented over the medium-term
- Existing vehicles can be retrofitted to use natural gas in a short period of time.

76. The project beneficiary countries can choose models for transition of their transport sectors based on their power balances, access to a natural gas network and perspectives of their energy sectors. Most of the project countries have the basic conditions for rapid development of an NGV market, including:

- A large difference in CNG and gasoline prices in favour of CNG
- A high natural gas network coverage
- Obvious need to reduce GHG emissions and particulate matter
- Barriers to rapid development and transition of their energy sector.

77. The regulatory authorities in the project countries can introduce the following changes:

- Make a comprehensive analysis of the transport and energy sectors and specify the fuel potential of every segment of the transport sector
- Understand the perspectives of the power mix over the long term
- Develop a comprehensive programme for development of an NGV market with an infrastructure layout based on potential demand
- Initiate simplification of technical regulations for CNG filling stations
- Develop a system for monitoring turnover of CNG cylinders
- Implement a programme for popularization of NGVs among the general public.

## Annex I

### Connection between NGV Market Development and the Sustainable Development Goals

<i>SDG</i>	<i>Influence factor</i>	<i>Description</i>
SDG 1: No poverty	<ul style="list-style-type: none"> <li>• Low price of natural gas compared to diesel and gasoline.</li> <li>• Low cost of CNG car ownership</li> </ul>	<ul style="list-style-type: none"> <li>• The lower the disposable income, the higher the share of transportation costs. The possibility to reduce transport costs is very sensitive for socially vulnerable segments of the population.</li> <li>• Mobility should be available and affordable for citizens. Transport transition should lead to reduction of transport and logistics costs due to cheap efficient fuel solutions.</li> <li>• Not only is the cost of fuel important for the consumer, but also the cost of the vehicle itself, which determines the cost of ownership over the entire life cycle. From this viewpoint, LPG and NGV seem the most attractive alternatives for cost reduction.</li> </ul>
SDG 3: Good health and well-being	NGV allows to minimize emissions of particulate matter (PM10, PM2.5)	<ul style="list-style-type: none"> <li>• The emissions of particulate matter (PM10, PM2.5) contain compounds of sulphur, heavy metals, aldehydes, benzopyrene, and have a particularly harmful effect on human health.</li> <li>• From the environmental and health perspectives, a share of petroleum fuels - gasoline, diesel and liquified petroleum gas (LPG) - needs to be firstly reduced.</li> </ul>
SDG 6: Clean water and sanitation	Use of natural gas as a motor fuel for water transport allows to avoid fuel spills	Globally, the most common source of drinking water are rivers and lakes. At the same time, these rivers and lakes are often used as transport infrastructure. Water transport affects the water quality. For water transport it is very important to use fuel that minimizes the risk of spillage of harmful substances into rivers and lakes. The most promising fuels from this point of view are electricity, LNG, and hydrogen.
SDG 8: Decent work and economic growth	Low price of natural gas compared to diesel and gasoline.	Acceleration of economic growth is possible by increasing the efficiency of the transport sector and reducing transport and logistics costs. One of the ways to reduce the cost of transportation is transition to cheaper and more efficient types of fuel, which today include electricity (in case of cheap power generation), LPG and natural gas. An additional factor is that these fuels cannot be stolen from the fuel tank, unlike gasoline and diesel.
SDG 9: Industry, innovation, and infrastructure	Development of CNG and LNG gas station infrastructure increases the access of final customer to natural gas as an alternative fuel	<ul style="list-style-type: none"> <li>• Providing access to different types of transport requires a refuelling infrastructure covering all alternative fuels on key transport routes. This fact presupposes the transformation of existing approaches to fuel infrastructure development. Key transport routes should be saturated with multi-fuel complexes that allow refuelling not only with gasoline and diesel, but also with CNG, LNG, hydrogen, and electricity.</li> <li>• Target 9.4: By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities.</li> </ul>

<i>SDG</i>	<i>Influence factor</i>	<i>Description</i>
SDG 10: Reduced inequalities	<ul style="list-style-type: none"> <li>• Low price of natural gas compared to diesel and gasoline.</li> <li>• Low cost of CNG car ownership</li> </ul>	<ul style="list-style-type: none"> <li>• People with a low income deserve access to a quality environment as much as those with a high income.</li> <li>• Providing access to cheaper types of environmental fuel (primarily natural gas) is one of the effective pathways to provide clean air in urban areas for people with low income. Introduction of cheap fuel increases the disposable income of households. NGV is a much cheaper way to improve urban air quality and contribute to decarbonization.</li> </ul>
SDG 11: Sustainable cities and communities	NGV allows to minimize the emissions of particulate matter (PM10, PM2.5)	<ul style="list-style-type: none"> <li>• The quality of urban environment and health of urban residents is mostly determined by the cleanliness of the air. Therefore, the transition of transport to the greener fuels is a key driver of sustainable development of modern cities.</li> <li>• By 2030, to be provided access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons.</li> </ul>
SDG #13. Climate action	CNG and LNG technologies are mature and can be simply implemented in medium-term	Transport emission reduction goal is more complex than reducing emissions in the power sector. Hydrogen seems to be the most attractive fuel for transition in the transport sector. But hydrogen technologies cannot be massively implemented in a short time. New supply chains for hydrogen are needed. Achieving Sustainable Development Goals until 2030 requires mature technologies.

## Annex II

### Overview of NGV Market Development in the Project Beneficiary Countries

Country	Population, thousand people	GDP per capita PPP, USD	Motorization rate, vehicles per 1000 people	Vehicle fleet, thousand	Carbon intensity			Share of CO <sub>2</sub> emissions from transport in total CO <sub>2</sub> emissions, %	Natural gas vehicles share, %	Number of natural gas fuel stations	Natural gas network coverage, %
					Tonnes of CO <sub>2</sub> - eqv. per capita	CO <sub>2</sub> per GDP, kg/USD	of road transport energy consumption, gr/MJ				
Armenia	2,957	14,258	111	350	1.8	0.2	61	28	80	96	96
Azerbaijan	10,000	15,041	118	1,170	3.1	0.2	71	25	-	6	96
Belarus	9,466	19,997	334	3,159	6	0.3	71.7	28	0.3	42	97
Bosnia and Herzegovina	3,301	15,883	263	920	6.7	0.5	72.8	14	No data	3	26
Bulgaria	6,975	24,789	334	2,773	5.7	0.3	67.5	20	2	121	No data
Kazakhstan	18,513	27,517	209	3,847	11.7	0.4	69	4	0.04	17	52
Kyrgyzstan	6,456	5,485	No data	No data	1.7	0.5	72.1	25	No data	6	20/52 in capital
North Macedonia	2,983	17,607	194	415	3.3	0.2	72.4	22	No data	8	Limited
Republic of Moldova	3,550	13,627	173	677	2.3	0.3	72.2	25	0.7	27	20/90
Romania	19,356	32,297	330	6,452	3.7	0.1	69.2	22.4	-	26	Limited
Serbia	6,944	19,013	252	1,715	6.4	0.4	72.6	16	No data	3	Limited
Tajikistan	9,321	3,529	38	300	0.8	0.2	72	17	No data	53	Limited
Turkmenistan	5,942	15,207	145	865	11.8	0.7	71.2	6	0	0	99
Uzbekistan	33,580	7,308	70	2,272	3.3	0.4	63.4	13	48	1070	85